

REMARKS

The claims have been amended to recite that the nonaqueous electrolyte of the lithium secondary battery of the present invention comprises a solute, a nonaqueous solvent and a wettability improving agent, and to limit the solute of the nonaqueous electrolyte to a lithium-containing salt. Support for these amendments is found in the specification, inter alia, in the description in paragraph [0025] of the solute of the nonaqueous electrolyte of the lithium secondary battery of the present invention.

The claims as amended are believed to be patentable under 35 U.S.C. § 102 and 35 U.S.C. § 103(a) over the Yoshimura et al., U.S. Patent Application Publication No. 2002/0051910 ("Yoshimura"), and Kim et al., U.S. Patent Application Publication No. 2003/0073005 ("Kim"), references cited in the Final Office Action dated March 17, 2008.

First, regarding Yoshimura, in the response filed July 17, 2008, to the Final Action, applicants explained that the separator of the battery of Yoshimura and, particularly, the separator of example 1.4 cannot, contrary to the Office's characterization, be properly identified as comprising a polyethylene as required in the present invention. Applicants explained that the separator of

Yoshimura comprises repeating units of p-phenylene combined with a group (A) and that the separator of comparative example 1.4 of Yoshimura, in which the group (A) combined with p-phenylene in the repeating units is an ethylene group, is not a polyethylene and does not comprise polyethylene. Applicants explained that a polyethylene is a polymer in which ethylene monomers combine with each other to form a long chain of carbon atoms. As evidence of this fact applicants provided a printout from the Polymer Science Learning Center. As further evidence of this fact applicants are submitting herewith pages 897 and 898 from *Hawley's Condensed Chemical Dictionary*, Thirteenth Edition, John Wiley & Sons, Inc. (1997). However, in comparative example 1.4 of Yoshimura, the ethylene units are separated by a phenylene unit and, therefore, the polymer is not a polyethylene.

The Office issued an Advisory Action in this application on August 6, 2008, in which it stated that the applicants arguments had been considered, but were not found to be persuasive. The Office did not explain why, in light of the evidence submitted by applicants, the polymer of comparative example 1.4 of Yoshimura could still be properly characterized as a polyethylene.

MPEP § 2145 provides that "[o]ffice personnel should consider all rebuttal arguments and evidence presented by applicants". MPEP

§ 706.07 provides that "[t]he examiner should never lose sight of the fact that in every case the applicant is entitled to a full and fair hearing, and that a clear issue between applicant and examiner should be developed, if possible, before appeal." Therefore, if the Office maintains its position that the polymer of comparative example 1.4 of Yoshimura is a polyethylene, it is respectfully requested to explain how the polymer meets the known and accepted meaning of "polyethylene" as explained in the evidence submitted by the applicants.

Second, regarding Kim, as noted above, the solute of the nonaqueous electrolyte of the present invention has been limited to a lithium-containing salt. This amendment distinguishes over the battery of Kim because the battery of Kim requires, as an electrolyte, a salt having an organic cation that is capable of dissolving sulfur-based positive active material. Kim describes on page 2, paragraph [0028], that "[t]he salts having the organic cation do not contain lithium ions." Kim cannot be properly modified to obtain the lithium secondary battery because such modification will destroy the invention on which Kim is based and is improper. See *Ex parte Hartmann*, 186 USPQ 366 (Bd. App. 1974).

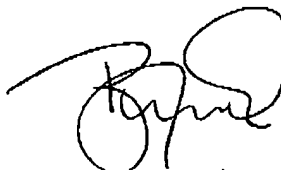
An allowance of the claims of the application is believed to be in order and is respectfully solicited.

The foregoing is believed to be a complete and proper response to the Office Action dated March 17, 2008, and is believed to place this application in condition for allowance. If, however, minor issues remain that can be resolved by means of a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney at the telephone number indicated below.

In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time. The fee for any such extension may be charged to our Deposit Account No. 111833.

In the event any additional fees are required, please also charge our Deposit Account No. 111833.

Respectfully submitted,
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Attachment: *Hawley's Condensed Chemical Dictionary*, Thirteenth Edition, John Wiley & Sons, Inc. (1997)

centrations as low as 1 ppm. In a given polyelectrolyte, ions of one sign are attached to the polymer chain, while those of opposite sign are free to diffuse into the solution. Major uses are flocculation of solids (especially dissolved phosphates) in potable water, dispersion of clays in oil-well drilling muds, soil conditioning, antistatic agents, and treatment of paper-mill wastewater. Ion-exchange resins are cross-linked (stabilized) polyelectrolytes. See flocculant; "Purifloc" [Dow]; "Cat-Floc" [Calgon].

polyene. Any unsaturated aliphatic or alicyclic compound containing more than four carbon atoms in the chain and having at least two double bonds. Examples are pentadiene, cyclooctatriene.

polyester fiber. Generic name for a manufactured fiber (either as staple or continuous filament) in which the fiber-forming substance is any long-chain synthetic polymer composed of at least 85% by weight of an ester of a dihydric alcohol and terephthalic acid (Federal Trade Commission). See "Dacron" [Du Pont]; polyethylene terephthalate.

Properties: Strength (staple) 2.2–4.0 g/denier; (continuous filament) up to 9.5 g denier, up 264C, water absorption 0.5%. Nonflammable.

Use: Tire fabric, seat belts, reinforcement of rubber hose for seawater cooling systems, as blend in clothing fabrics, fire-hose jackets.

polyester film. Continuously extruded polyester sheet of various thicknesses, especially useful in electrical equipment because of its high resistivity. Its tensile strength of 25,000 psi is much greater than that of other plastic films. Sensitized polyester film is used in magnetic tapes, in the photocopying technique known as reprography.

polyester resin. Any of a group of synthetic resins, which are polycondensation products of dicarboxylic acids with dihydroxy alcohols. They are thus a special type of alkyd resin but, unlike other types, are not usually modified with fatty acids or drying oils. The outstanding characteristics of these resins is their ability, when catalyzed, to cure or harden at room temperature under little or no pressure. Most polyesters now produced contain ethylenic unsaturation, generally introduced by unsaturated acids. The unsaturated polyesters are usually cross-linked through their double bonds with a compatible monomer, also containing ethylenic unsaturation, and thus become thermosetting. Flame resistance is imparted by using either acid or glycol ingredients having a high content of halogens, e.g., HET acid.

The principal unsaturated acids used are maleic and fumaric. Saturated acids, usually phthalic and adipic, may also be included. The function of these acids is to reduce the amount of unsaturation in the final resin, making it tougher and more flexible. The

acid anhydrides are often used if available and applicable. The dihydroxy alcohols most generally used are ethylene, propylene, diethylene, and dipropylene glycols. Styrene and diallyl phthalate are the most common cross-linking agents. Polyesters are resistant to corrosion, chemicals, solvents, etc.

Available forms: Sheets, powder, chips.

Use: Reinforced plastics; automotive parts; boat hulls; foams; encapsulation of electrical equipment; protective coatings; ducts, flues, and other structural applications; low-pressure laminates; magnetic tapes; piping; bottles; nonwoven disposable filters; low-temperature mortars.

See alkyd resin; polyester fiber.

polyethenoid. Characterizing an aliphatic compound having more than one ethene group $-\text{CH}=\text{CH}-$. Linoleic acid is a polyethenoid fatty acid.

polyether. A polymer in which the repeating unit contains a $\text{C}-\text{O}$ bond derived from aldehydes or epoxides or similar materials.

polyether, chlorinated. A highly crystalline material that is 46% chlorine. Outstanding corrosion resistance. Good electrical resistance. Readily processed and fabricated.

Use: Fluid-bed coating, tank linings, piping, valves, laboratory equipment, chemical processing equipment.

polyether, cyclic. See crown ether.

polyether foam. A polyurethane foam, either rigid or flexible, made by use of a polyether as distinct from a polyester or other resin component. **Hazard:** As for polyurethane.

polyether glycol. A compound with a structural skeleton such as $\text{HO}-\text{C}-\text{C}-\text{O}-\text{C}-\text{C}-\text{O}-\text{C}-\text{C}-\text{OH}$. The length of the chain can vary widely, and the number of consecutive carbon atoms may be greater than two. Examples are polyethylenic glycol and polypropylene glycol.

polyethylene.

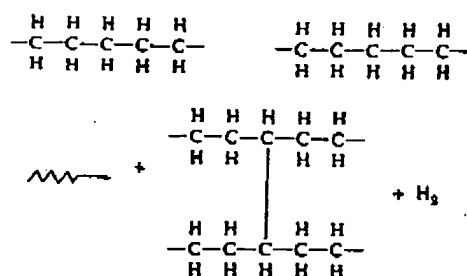
CAS: 9002-88-4. ($-\text{H}_2\text{C}-\text{CH}_2-$).

Chlorosulfonated. See "Hypalon" [Du Pont].

Cross-linked (XLPE).

Properties: Thermoplastic white solid, high-temperature-resistant, excellent resistance to chemicals and to creep, high impact and tensile strength, high electrical resistivity, insoluble in organic solvents, does not stress-crack. Combustible.

Derivation: (1) By irradiating linear polyethylene with electron beam or γ radiation, cross-linking taking place through a primary valence bond, as shown.



(2) By chemical cross-linking agent such as an organic peroxide (e.g., benzoyl peroxide). All grades of polyethylene and most copolymers can be chemically cross-linked.

Use: Wire and cable coatings and insulation (low-density grades), pipe and molded fittings (high-density grades). Special types having low electrical resistivity can be made; these can be regarded as semiconductors.

Note: In molding cross-linked polyethylene, the desired part must be formed before cross-linking is initiated, because material will not change its shape after cross-linking. The variations in composition and wide range of properties approach the ideal of a universal material more closely than most polymers.

Density

The density of polyethylene and other thermoplastic polymers is affected by the shape and spacing of the molecular chains; low-density materials have highly branched and widely spaced chains, whereas high-density materials have comparatively straight and closely aligned chains. Polymers of the latter type are called linear. The physical properties are markedly affected by increasing density.

Low density (branched chain)

Properties: Crystallinity 50–60%. D 0.915, mp 240F, tensile strength 1500 psi, impact strength above 10 ft-lb/inch/notch, thermal expansion 17×10^{-3} inch/inch/C. Soluble in organic solvents above 200F; insoluble at room temperature.

Derivation: (1) Ethylene is polymerized in a free-radical-initiated liquid-phase reaction at 1500 atm (22,000 psi) and 375F with oxygen as catalyst (usually from peroxides). (2) A much more effective and cheaper process uses pressures of only 100–300 psi at less than 212F; the catalyst is undisclosed and reaction is vapor phase.

Use: Packaging film (especially for food products), paper coating, liners for drums and other shipping containers, wire and cable coating, toys, cordage, refuse and waste bags, chewing-gum base, squeeze bottles, electrical insulation.

High density (linear)

Properties: Crystallinity 90%. D 0.95, mp 275F, tensile strength 4000 psi, impact strength 8 ft-lb/inch notch, high electrical resistivity, film is gas-permeable, hydrophobic, does not resist nitric acid.

Derivation: Ethylene polymerized by Ziegler catalysts at 1–100 atm (15–1500 psi) at room temperature to 200F. Catalyst is a metal alkyl, e.g., triethylaluminum plus a metallic salt (TiCl_4) dissolved in a hydrocarbon solvent. A vapor-phase modification of this process was developed in 1965. Another method uses such metallic catalysts as Cr_2O_3 at 100–500 psi with solvents such as cyclohexane or xylene.

Use: Blow-molded products, injection-molded items, film and sheet, piping, fibers, gasoline and oil containers.

Note: Ethylene may be copolymerized with varying percentages of other materials, e.g., 2-butene or acrylic acid; a crystalline product results from copolymerization of ethylene and propylene. When butadiene is added to the copolymer blend, a vulcanizable elastomer is obtained.

Low molecular weight

Properties: Molecular weight 2000–5000. Translucent white solids, excellent electrical resistance; abrasion resistant, resistant to water and most chemicals, d 0.92. Slightly soluble in turpentine, petroleum naphtha, xylene, and toluene at room temperature; soluble in xylene, toluene, trichloroethylene, turpentine, and mineral oils at 82.2C; practically insoluble in water; slightly soluble in methyl acetate, acetone, and ethanol up to the boiling points of these solvents. Available as emulsified and nonemulsified forms. Combustible.

Use: Mold-release agent for rubber and plastics, paper and container coatings, liquid polishes, and textile finishing agents.

polyethylene glycol. (PEG; poly(oxyethylene); polyglycol; polyether glycol).

CAS: 25322-68-3. Any of several condensation polymers of ethylene glycol with the general formula $\text{HOCH}_2(\text{CH}_2\text{OCH}_2)_n\text{CH}_2\text{OH}$ or $\text{H}(\text{OCH}_2\text{CH}_2)_n\text{OH}$. Average molecular weights range from 200 to 6000. Properties vary with molecular weight.

Properties: Clear, colorless, viscous liquids to waxy solids; odorless. Soluble or miscible with water and for the most part with alcohol and other organic solvents, heat-stable; inert to many chemical agents. Do not hydrolyze or deteriorate. Have low vapor pressure. Combustible.

Derivation: By condensation of ethylene glycol or of ethylene oxide and water.

Use: Chemical intermediates (lower molecular weight varieties), plasticizers, softeners and humectants, ointments, polishes, paper coating, mold lubricants, bases for cosmetics and pharmaceuticals, solvents, binders, metal and rubber processing, permissible additives to foods and animal feed, laboratory reagent.

See "Carbowax" [Union Carbide].

polyethylene glycol chloride.

$\text{H}(\text{OCH}_2\text{CH}_2)_n\text{Cl}$. Any of a group of polymers, usually colorless liquids with very low vapor pressure.